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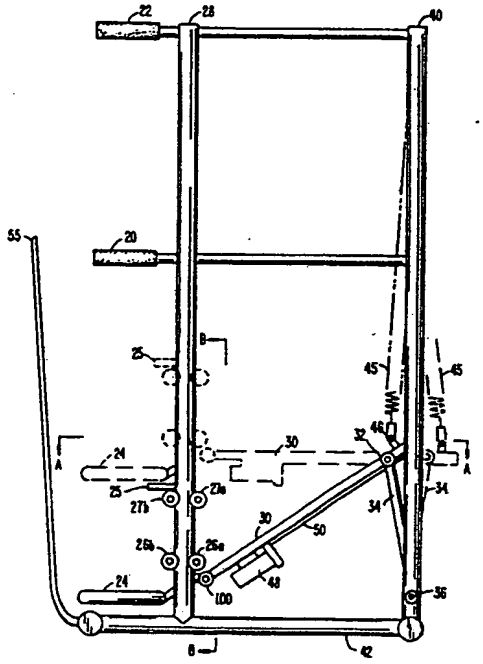
(54) Title: IMPROVED UPPER BODY EXERCISE APPARATUS

(57) Abstract

An upper body exercise apparatus to assist an exerciser to do chin-ups and dips. The apparatus includes a frame having a base (42), a platform (24) parallel to the base for the exerciser to stand on, and chin-up handles (22) and dip handles (20) extending from the frame. A motive device comprising a spring (45) driven by an electric motor (48) moves the platform vertically between an lower position and an upper position while maintaining the platform parallel to the base avoiding any angular displacement. The system further includes a control and monitor whereby the force is controlled and the oscillation of the platform is monitored.



IMPROVED UPPER BODY EXERCISE APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to an improved exercise device for the upper body muscles that provides an upward, vertical force to assist the exerciser with chin-ups and dips. Chin-up or dip exercises require strong upper body muscles. In most exercisers, these upper body muscles are not sufficiently developed and the exercises can only be performed with great difficulty if at all.

Typical upper body exercise apparatuses either provide no assistance to the exerciser or are cumbersome to use and operate. For example, the device described in the patent to Roberts, U.S. Patent 4,111,414, requires the user to step into a harness while manually adjusting weights. Other devices provide a platform on which the exerciser stands, but the force applied to assist the exerciser either causes arcuate motion of the platform, or provides a non-linear assist force.

In particular, McFee in U.S. Patent No. 4,470,587, illustrates an oscillating platform articulated to a parallelogram assembly having fixed pivot points. Thus, as the platform moves from an initial position to an upper position, the platform must necessarily traverse an arc. The arcuate motion of the platform causes the user's feet to traverse an arc while the user's hands grip the chin-up or dip handles and a true chin-up or dip exercise cannot be performed.

The Martin device, U.S. Patent No. 4,452,447, contains an oscillating platform attached to relatively short elastic spring members which provide an upward force to assist the user. The elastic members behave in a similar fashion to springs and the amount of assistance force therefore varies with the displacement of the platform.

One device described in Potts U.S. Patent 4,846,458, does disclose an oscillating platform with essentially uniform upward force and free of arcuate motion. The Potts device uses

a system of levers and hydraulic lifts to move the platform. As the platform moves up and down, a short arm causes the effective length of the moment arm to change. The change in moment arm compensates for the nonlinearity of the pneumatic lifters and provides a substantially linear assist force to the platform. An accumulator and air compressor motor are used to control the volume of fluid in the pneumatic cylinder and thus the amount of assist provided to the user.

Although this device achieves an essentially constant upward force with no arcuate motion of the platform, a multiplicity of pneumatic devices and levers are needed. These pneumatic devices and levers increase the cost of manufacturing in terms of both component costs and labor. The pneumatic cylinders of the device also require a period of time to charge to the desired level. Similarly, when the user has completed exercising on the device, a period of time is required for the cylinders to fully discharge before the user can step off the machine.

SUMMARY OF THE INVENTION

According to one embodiment, the exercise device of the present invention replaces the pneumatic cylinder and lever system with an electric motor and jack screw. A spring attached to an actuator arm provides a vertical force to an oscillating platform which provides an assist to the user. The platform contains a set of four rollers which guide the platform vertically along the frame posts of the device. The rollers prevent horizontal displacement of the platform and thus prevent platform arcuate motion. The electric motor drives the jack screw which alters the location where the spring is attached to the actuator arm. Altering the spring location varies the moment arm of the actuator arm and adjusts the amount of assist provided to the user. A microprocessor runs a motor controller which governs operation of the electric motor. A further reduction in cost is possible by removing two of the rollers which support the platform.

The device of the present invention thus provides the user with a more convenient, more reliable, less costly means

for doing dip and chin-up exercises. The exercise apparatus of the present invention also provides a variable, but substantially linear assist force to the platform without inducing platform arcuate motion. The exercise device of the present invention thus enables persons of all fitness levels to perform proper dip and chin-up exercises. The reduced complexity of the device also means that the exercise benefits of the device can be had at a reduced cost.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of an upper body exercise apparatus according to an embodiment of the present invention;

Fig. 2 shows section A-A of the drawing of an upper body exercise apparatus as shown in Fig. 1;

Fig. 3 shows section B-B of the drawing of an upper body exercise apparatus as shown in Fig. 1;

Fig. 4 shows an exerciser mounting an upper body exercise apparatus according to an embodiment of the present invention;

Fig. 5 shows an exerciser in position to grab chin-up exercise handles according to an embodiment of the present invention;

Fig. 6 shows a control console according to an embodiment of the present invention;

Fig. 7 shows an exerciser stepping into an initial starting position for a chin-up exercise according to an embodiment of the present invention; and

Fig. 8 shows an exerciser in a completed chin-up exercise according to an embodiment of the present invention.

DESCRIPTION OF SPECIFIC EMBODIMENTS

Fig. 1 shows a side view of an exercise apparatus on which chin-ups and dips can be performed according to one embodiment of the present invention. To perform a dip exercise, the exerciser begins with the arms extended downward, and hands gripping handles 20. Handles 20 and 22 are covered by a grip to prevent slipping. The exerciser lowers the body by bending at the elbows and then straightens the elbows to

lift the body back to the starting position. To perform a chin-up, the exerciser grabs handle 22 located above his/her head and pulls the body upward. In both exercises, the exerciser must overcome the force of gravity. Repetitions of the exercises develop strength and stamina and also promote physical fitness.

Not every exerciser has developed the muscle strength necessary to counteract their own weight and perform chin-up and dip exercises unassisted, or to perform repetitions of the exercise. The exercise device of the present invention therefore includes mechanisms which can provide a vertical force opposite the force of gravity to counteract the exerciser's weight and assist in performance of the exercises.

One embodiment of the present invention includes an L-shaped platform 24 on which the exerciser may stand or otherwise mount the apparatus. A step 25 is provided on the vertical portion of L-shaped platform 24 to assist users in reaching the upper set of handles 22. The vertical portion of L-shaped platform 24 also contains a set of four rollers 26a, 26b, 27a, 27b which are located around each side of a vertical frame post 28. A similar set of four rollers, e.g., 27a', 27b', 26a', 26b', couple the platform to a second vertical frame post 29 (Figs. 2 and 3). Alternately, the top set of rollers 27 may be omitted to curb production costs in this embodiment of the invention. Rollers 26, 27 allow platform 24 to travel vertically along frame posts 28 and 29 and prevent the platform from travelling horizontally thereby ensuring that platform 24 has no arcuate motion. Section B-B of Fig. 3 and Fig. 1 show travel of platform 24 from first elevated position, indicated by phantom lines, to a second, floor level position.

As shown in Fig. 1, L-shaped platform 24 is connected by a first pivot 100 to an actuating arm 30 which has a second pivot 32 located some distance from platform 24. As seen in Fig. 2, the actuating arm 30 is Y-shaped, having two arms 31a, 31b. One end of a first pivoting rod 34 attaches to actuating arm 30 at pivot point 32 and the other end attaches to a second pivot 36, located on vertical supports 40 near the base 42 of the apparatus. A second pivoting arm 35 attaches to the

actuating arm 30 and to a second vertical support 41. A spring 45 is pivotally attached to actuating arm 30 at a point 46 and pivotally secured to the device frame. Spring 45 provides a motive force to platform 24 for moving the platform vertically. The position of spring 45 relative to pivot 32 determines the moment of the spring force with respect to the pivot 32 and thus determines the amount and direction of the force applied to platform 24 by the spring 45. An electric motor 48, drives a jack screw 50 to position the spring attachment point 46 along actuating rod 30. In Fig. 1, spring 45 is positioned aft of pivot 32. The force exerted by spring 45 on actuator rod 30 has therefore caused platform 24 to move from an elevated position, as shown by dashed lines in the figure, to a floor level position shown in solid lines.

As platform 24 moves vertically, pivot point 32 traverses an arc. The arcuate motion of pivot point 32 causes a slight changes in the length of spring 45. On the vertically ascending portion of the arc, spring 45 contracts and the force exerted by spring 45 decreases. Conversely, on the descending portion of the arc traversed by rod 34, spring 45 lengthens with a corresponding increase in force. These force variations, if uncorrected, provide a nonconstant assist force to the user.

To compensate for the spring force variations, and for changes in the movement arm, electric motor 48 and jack screw 50 alter the attach position 46 of spring 45 during motion of platform 24. As spring 45 shortens during upward vertical motion of platform 24, jack screw 50 drives the spring attach point 46 from the initial point to a point further from pivot 32. The increased distance from pivot 32 compensates for the decrease in spring force and maintains a moment of constant magnitude about pivot 32. The mechanism of the present invention thus provides a substantially constant force to platform 24 and the degree of assistance provided to the user at the beginning of an exercise stroke is identical to the assistance provided at the end of the exercise stroke.

The operation of this embodiment of the invention is best described by way of example. Fig. 4 shows a user A

stepping onto platform 24 to begin a chin-up exercise. A safety rail 55 prevents user A from falling backwards off platform 24. Once on platform 24, user A faces a control monitor 68 (not visible in Fig. 4). An enlarged view of the monitor 68 is shown in Fig. 6. After turning on the apparatus with switch 89, the exerciser enters his/her weight using keypad 90. The amount of upward assistance force desired by the user can be entered as a percentage of the user's weight using bar graph 92. Panel 68 then displays the net weight to be lifted. As the exercise is performed, the number of repetitions and elapsed time will also be displayed.

Control panel 68 contains a microprocessor which controls electric motor 48, e.g. using a digitally controllable motor controller (not shown). The microprocessor computes the weight to be lifted as the given percentage of the entered weight. The distance of spring 45 from pivot 32 necessary to impart this force to the platform is then calculated according to well known techniques. For example, the relationship

$$\vec{M} = \vec{F}_1 \times \vec{d}_1,$$

where: $\vec{M}$ = vector moment about the pivot

$\vec{F}_1$ = vector spring force

$\vec{d}_1$ = displacement from the spring attach point to the pivot

can be used.

In response to the microprocessor, electric motor 48 drives jack screw 50 the required number of revolutions to position spring 45 in the desired position along actuating arm 30. As shown in Fig. 5, the spring attachment point 46 is positioned forward of the pivot point 32. The desired upward force is imparted to platform 24 once spring 45 is in this position. The sum of the vertical forces on platform 24 equals the user's weight plus the upward vertical force provided to the platform by the spring mechanism. So long as the percentage weight to be lifted by platform 24 is less than 100%, the net vertical force will be down and platform 24 will remain at floor level when user A is at rest as shown in Fig. 4. A large number of people cannot reach handles 22 when

platform 24 is at floor level. To reach handles 22, user A must step on step 25 as shown in Fig. 5. With both feet on step 25, user A can now easily grab onto handles 22. With User A's weight supported on the step 25 and handles 22, the net force on platform 24 is vertically upward and the platform begins to rise. Once platform 24 has travelled a sufficient distance, user A may step back down onto platform 24 as shown in Fig. 7 to begin the chin-up exercise.

Users of various sizes need only wait until platform 24 travels to the height preferred by that user for beginning the exercise. Exercisers of all sizes are accommodated by this procedure. No need to adjust the handles exists because platform 24 travels upward to meet the user. Handles 20 and 22 can therefore be fabricated as fixed elements to save costs over systems requiring adjustable handles. Alternatively, however, the present invention may be fabricated with adjustable handles.

From the initial starting position shown in Fig. 7, Exerciser A then begins to pull himself up with the aid of the force supplied by the platform. As the exerciser moves in an upward vertical direction, L-shaped platform 24 travels upward, guided along frame posts 28 and 29. Rollers 26 prevent arcuate motion of L-shaped platform 24 by preventing horizontal displacement of the platform relative to vertical frame posts 28 and 29. As the platform rises, contact of the rollers 26, 27 with the frame posts 28 and 29 provides a force which causes member 34 to pivot about pivot 36 as the height of the platform increases.

The upward force exerted by the exerciser and the upward force imparted to the exerciser via platform 24 provide the net force necessary to complete upward stroke of the exercise. Once at the top of the upward stroke of the exercise shown in Fig. 8, the exerciser stops exerting an upward force to pull himself up. When the exerciser ceases to exert an upward force, the exerciser's own weight will be greater than and in an opposite direction from the upward force provided by

platform 24. Platform 24 will slowly sink back to the initial starting position and repetitions of the exercise may be performed.

Upon completion of the desired number of exercises, User A can let go of handles 22 and remain at rest. Platform 24 will slowly sink back to the floor position since the user's weight exceeds the upward force provided by the platform. When the exerciser indicates he has completed his exercise (e.g., by entering a command at the keyboard 68) motor 48 and jack screw 50 position the attach point 46 of spring 45 aft of pivot 32 (as shown in Fig. 4) so that platform 24 remains at floor level. In this configuration, User A can dismount the machine and subsequent users mount the machine.

As may be seen from the above description, the present invention provides a system for assisting the user in chin-up and dip exercises with a constant force and free of arcuate motion. The present invention achieves these ends without the need for a complicated system of hydraulic devices and levels. For this reason, the exercise apparatus of the present invention may be had at reduced cost and improved convenience and reliability.

The preferred embodiments of the invention have now been described. Variations and modifications will be readily apparent to those skilled in the art. For example, the method of computing spring position along the actuator arm may take many forms, including but not limited to, finite element analysis, numerical analysis servo or feedback methods and computation by direct measure. By making the spring 45 sufficiently long, the amount of compression, as a fraction of spring length, will be small and thus departures from linearity can be reduced to the point that little or no jackscrew movement will be needed to maintain a substantially linear force. In this situation, the jackscrew could be used to set an initial level of force which need not be adjusted during each exercise stroke. Also, console 68 may have many variations in the organization and types of information input and displayed. Furthermore, other mechanisms which guide

vertical travel of platform 24 along the frameposts and prevent horizontal motion can be used in place of rollers. For these reasons, the invention should be construed in light of the claims.

5

WHAT IS CLAIMED IS:

1. An upper body exercise apparatus to assist an exerciser comprising:

a frame having a base;

a platform parallel to said base for said exerciser to stand on;

at least a first handle extending from said frame;

an actuating arm, having a first pivot, and coupled to said platform;

means for exerting a force on said actuating arm such that said actuating arm rotates about said first pivot and imparts a substantially constant force, having a component opposite the force of gravity, to said platform; and

means for positioning said means for exerting a force along said actuating arm to adjust said force provided to the platform.

2. The upper body exercise apparatus of claim 1 wherein the means for exerting a force comprises a spring.

3. The upper body exercise apparatus of claim 1 wherein the means for positioning said means for exerting a force comprises:

a motor; and

a jack screw.

4. The upper body exercise apparatus of claim 1 wherein said first handle is positioned in a fixed relationship to said base.

5. The upper body exercise apparatus of claim 1 further comprising a means for maintaining said platform parallel to said base and avoiding any horizontal displacement of said platform.

6. An upper body exercise apparatus to assist an exerciser, which comprises:

a frame having a base;

a platform parallel to said base for said exerciser to stand on;

at least a first handle extending from said frame;

means for oscillating said platform vertically between a lower position and an upper position while maintaining said platform parallel to said base and while avoiding arcuate motion of said platform;

spring means, operably connected to said oscillating means, for providing a substantially constant force on said exerciser; and

said force having a component opposite the force of gravity on the exerciser and wherein said force is exerted while the exerciser at least partially lifts himself using said handle.

7. An upper body exercise apparatus to assist an exerciser, which comprises:

a frame having a base;

a platform parallel to said base for said exerciser to stand on;

at least a first handle positioned in a fixed relationship to said base;

oscillating means for moving said platform vertically between a lower position and an upper position while maintaining said platform parallel to said base;

spring means for providing a force to said oscillating means;

said force having a component opposite the force of gravity on the exerciser, and said force exerted while the exerciser at least partially lifts himself using said handle; and

wherein said oscillating means lifts said exerciser from said lower position to a position for grasping said handle without the necessity for adjusting the position of said handle with respect to said frame.

8. A method for upper body exercise, comprising:
providing a frame having a base;
providing a platform parallel to said base for said exerciser to stand on;
providing at least a first handle extending from said frame;
coupling said platform to said frame using an actuating arm, said actuating arm having a first pivot;
exerting a force on a location along said actuating arm to rotate said actuating arm about said first pivot and impart a substantially constant force, having a component opposite the force of gravity, to said platform;
adjusting the force provided to the platform by adjusting said location along said actuating arm where said force is exerted.

9. A method, as claimed in claim 8, wherein said step of adjusting comprises:
providing a control panel, said control panel including a keypad and a processor;
inputting a weight using said keypad;
processing at least said weight, using said processor, to provide an indication of said location.

10. A method, as claimed in claim 9, further including inputting an indication of a desired level of effort, using said keypad, and wherein said step of processing includes:
processing at least said weight and said indication of a desired level of effort, using said processor, to provide an indication of said location.

11. A method, as claimed in claim 8, wherein said step of adjusting includes turning a jackscrew which adjusts said location and wherein said indication of location is an indication of a number of turns of said jackscrew.

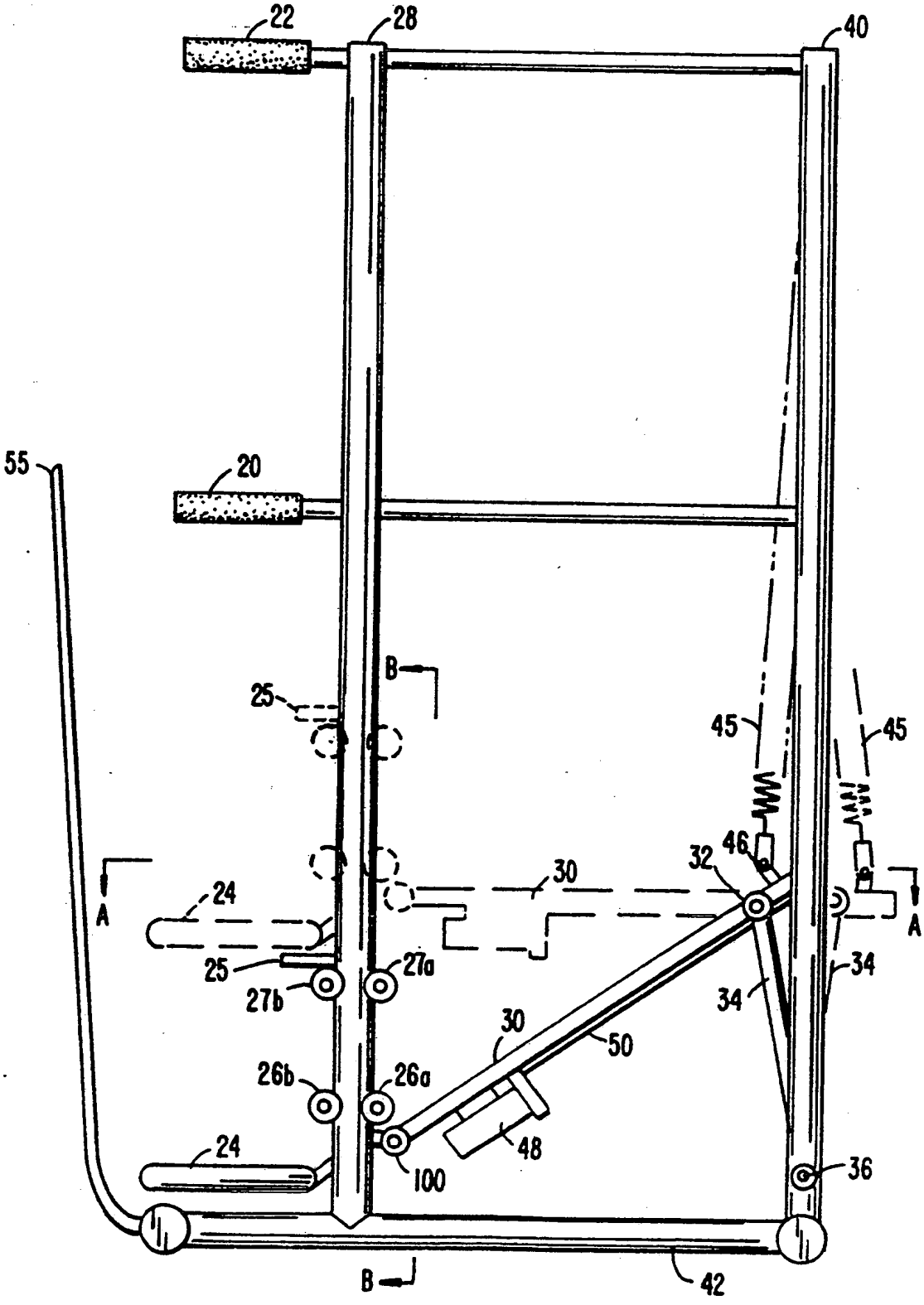

22
28
40
55
20
B
25
45
45
46
32
30
A
24
A
25
27a
27b
34
34
30
50
26b
26a
24
48
100
36
B
42

FIG. 1.

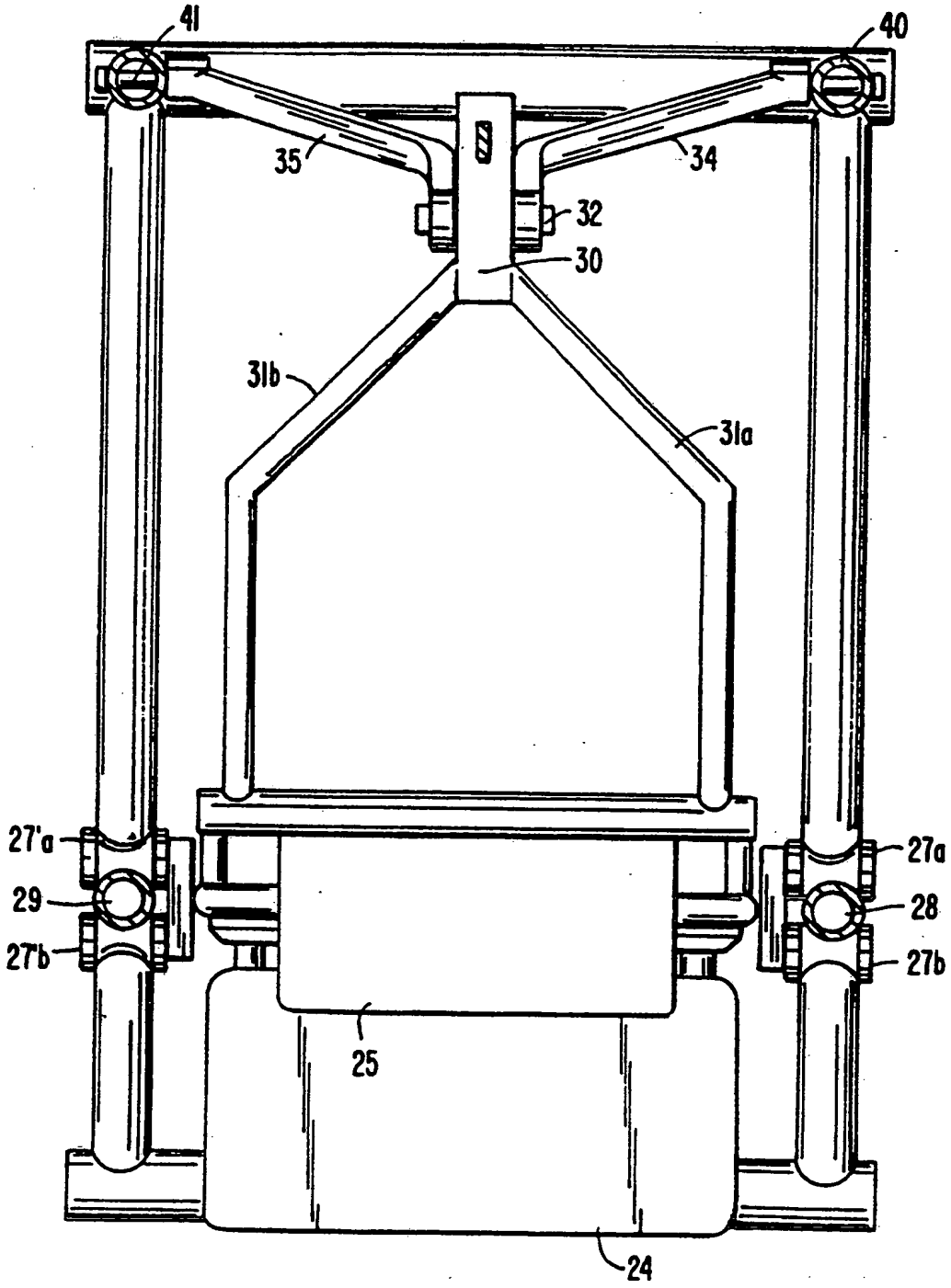


FIG. 2.

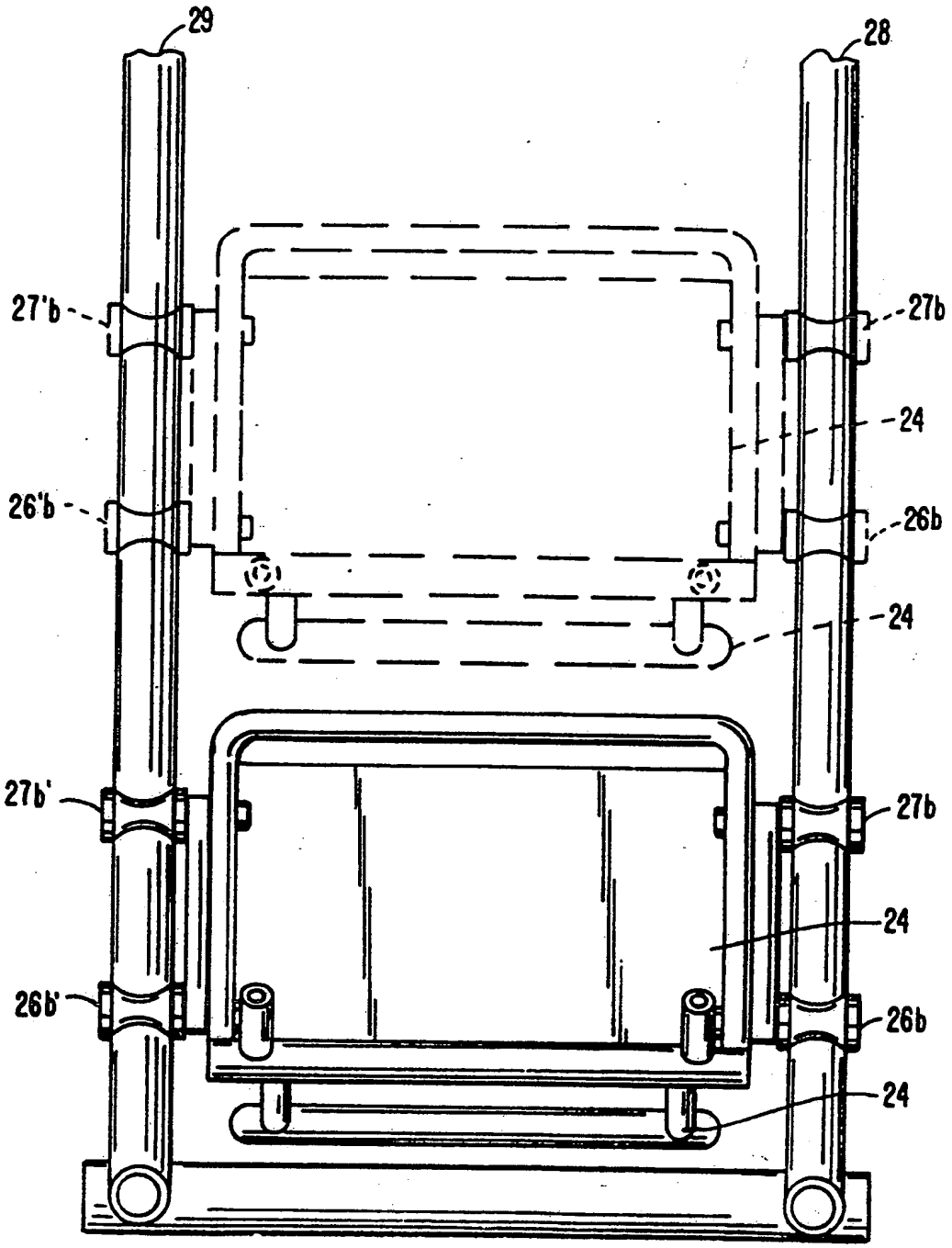


FIG. 3.

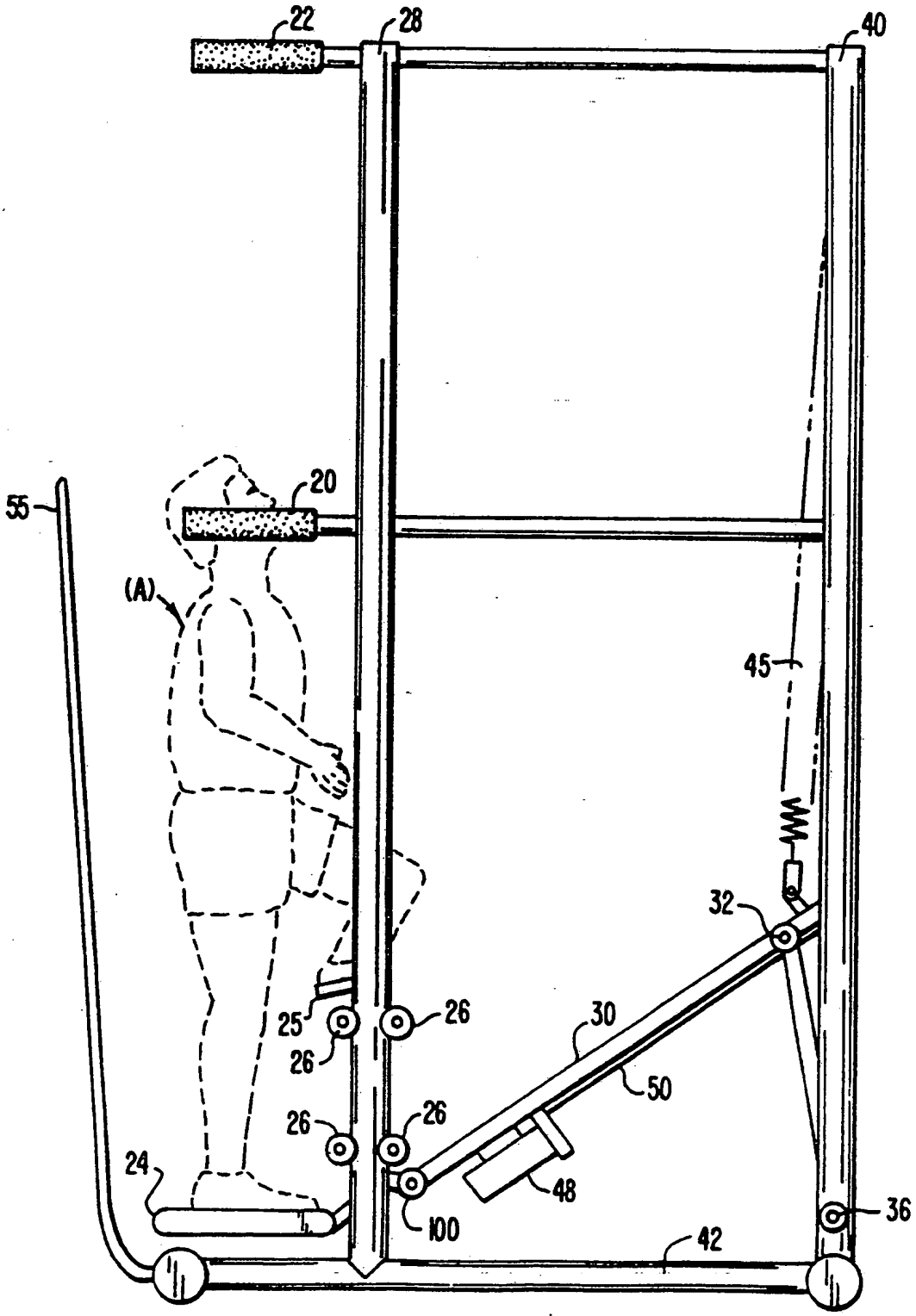


FIG. 4.

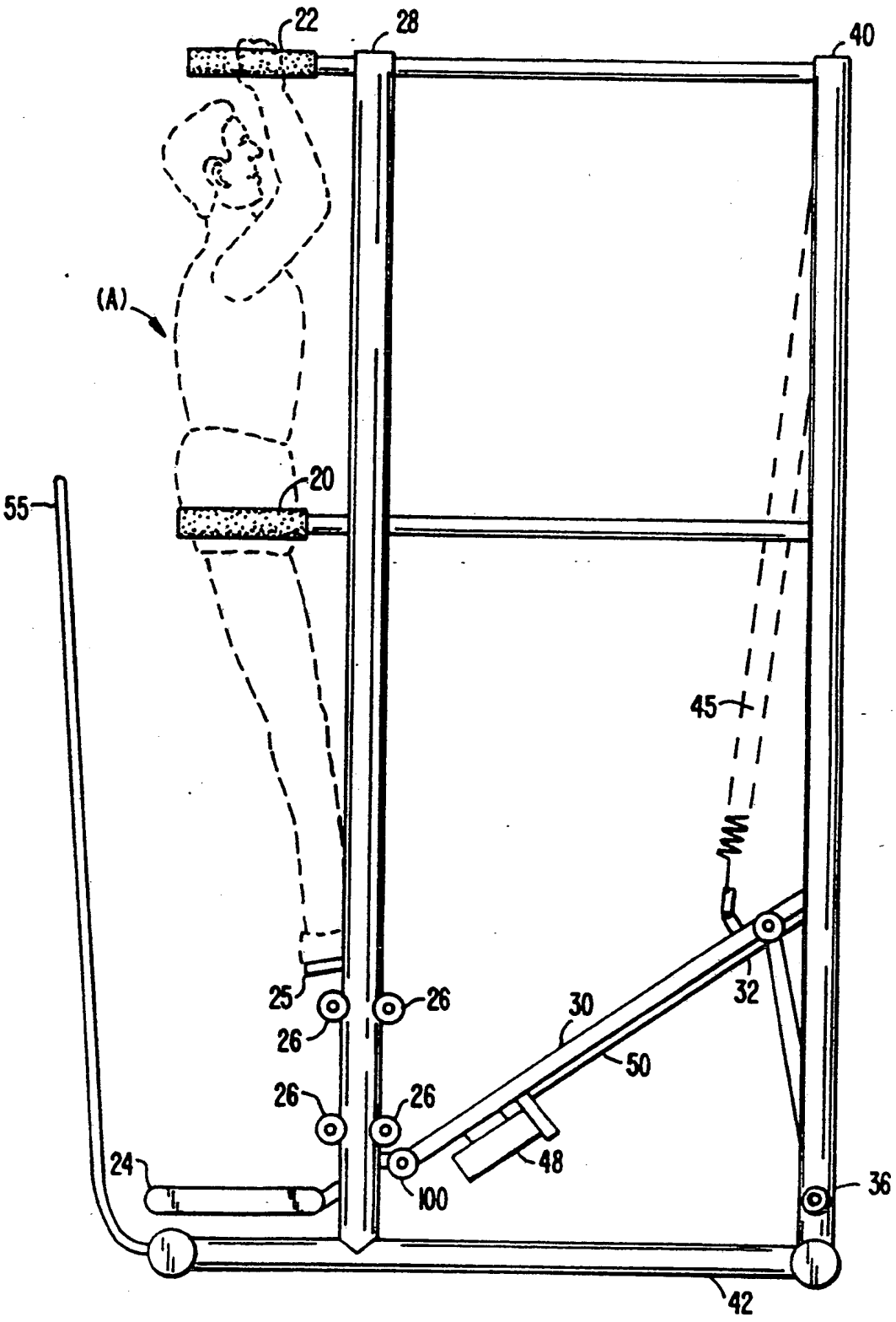


FIG. 5.

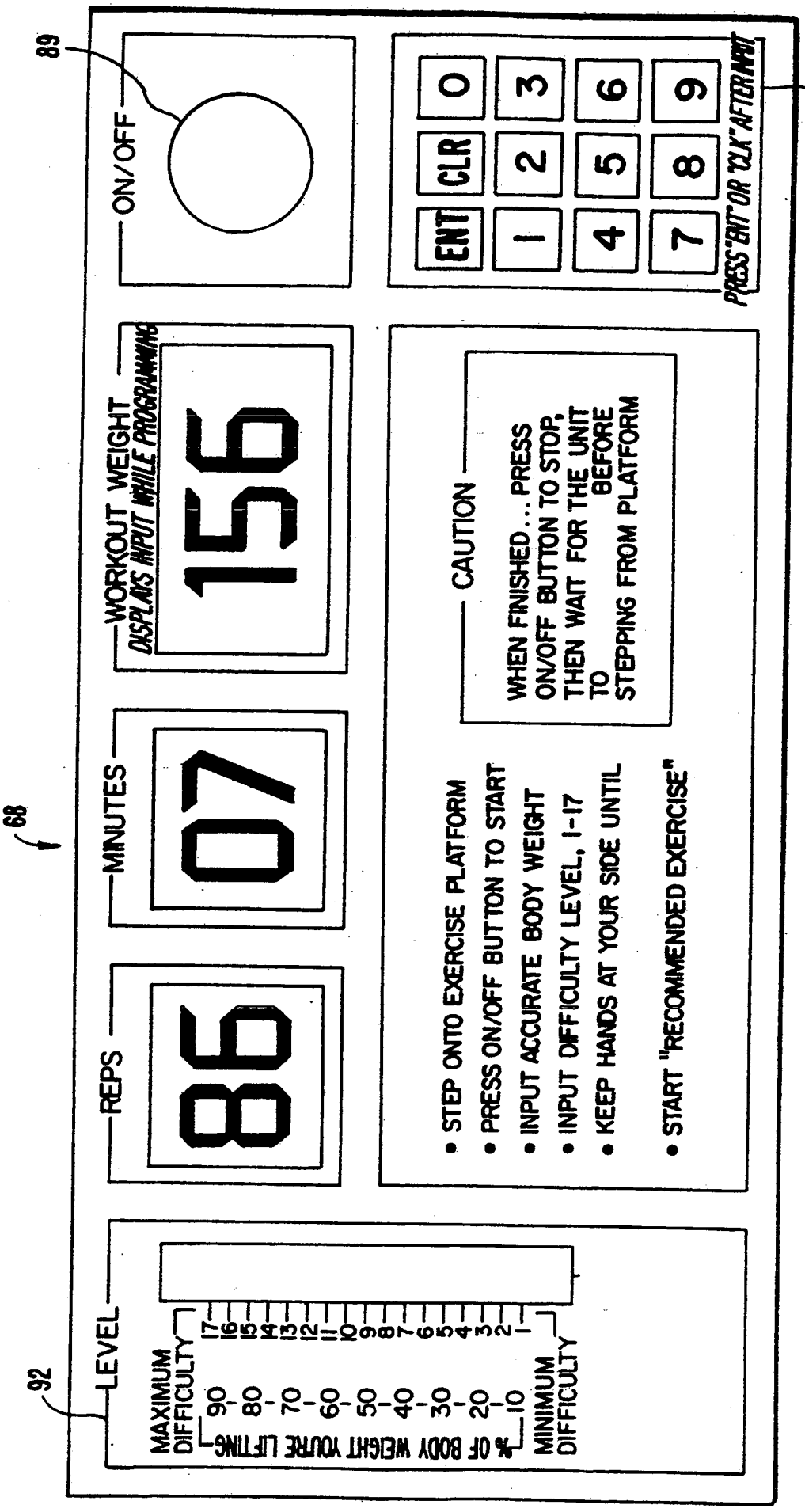

89
ON/OFF
WORKOUT WEIGHT
DISPLAYS INPUT WHILE PROGRAMMING
156
ENT
CLR
0
1
2
3
4
5
6
7
8
9
PRESS "ENT" OR "CLK" AFTER INPUT
90
68
REPS
86
MINUTES
07
CAUTION
WHEN FINISHED... PRESS ON/OFF BUTTON TO STOP, THEN WAIT FOR THE UNIT TO BEFORE STEPPING FROM PLATFORM
• STEP ONTO EXERCISE PLATFORM
• PRESS ON/OFF BUTTON TO START
• INPUT ACCURATE BODY WEIGHT
• INPUT DIFFICULTY LEVEL, 1-17
• KEEP HANDS AT YOUR SIDE UNTIL
• START "RECOMMENDED EXERCISE"
92
LEVEL
MAXIMUM DIFFICULTY
MINIMUM DIFFICULTY
% OF BODY WEIGHT YOU'RE LIFTING
17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
90 80 70 60 50 40 30 20 10

FIG. 6.

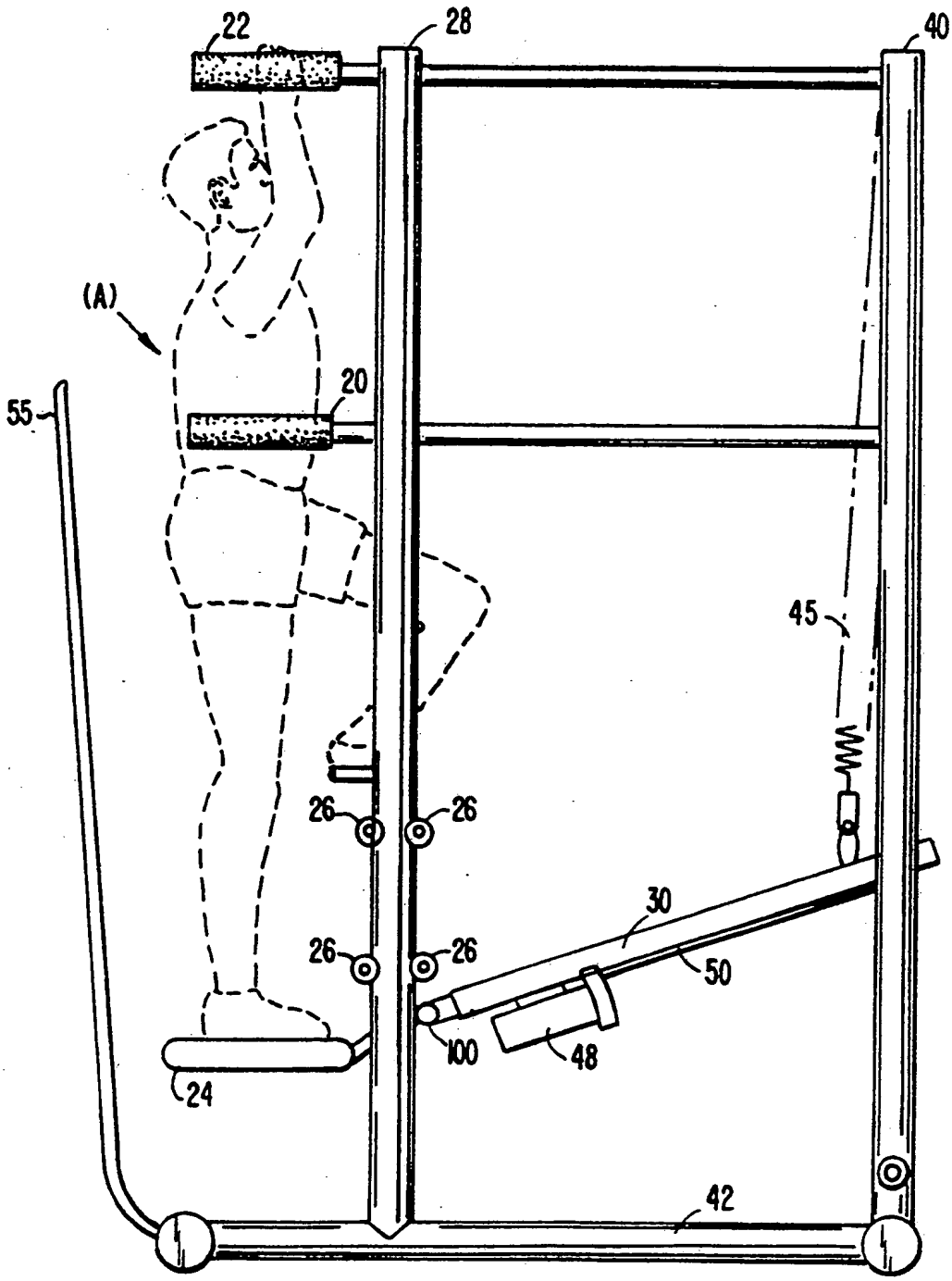


FIG. 7.

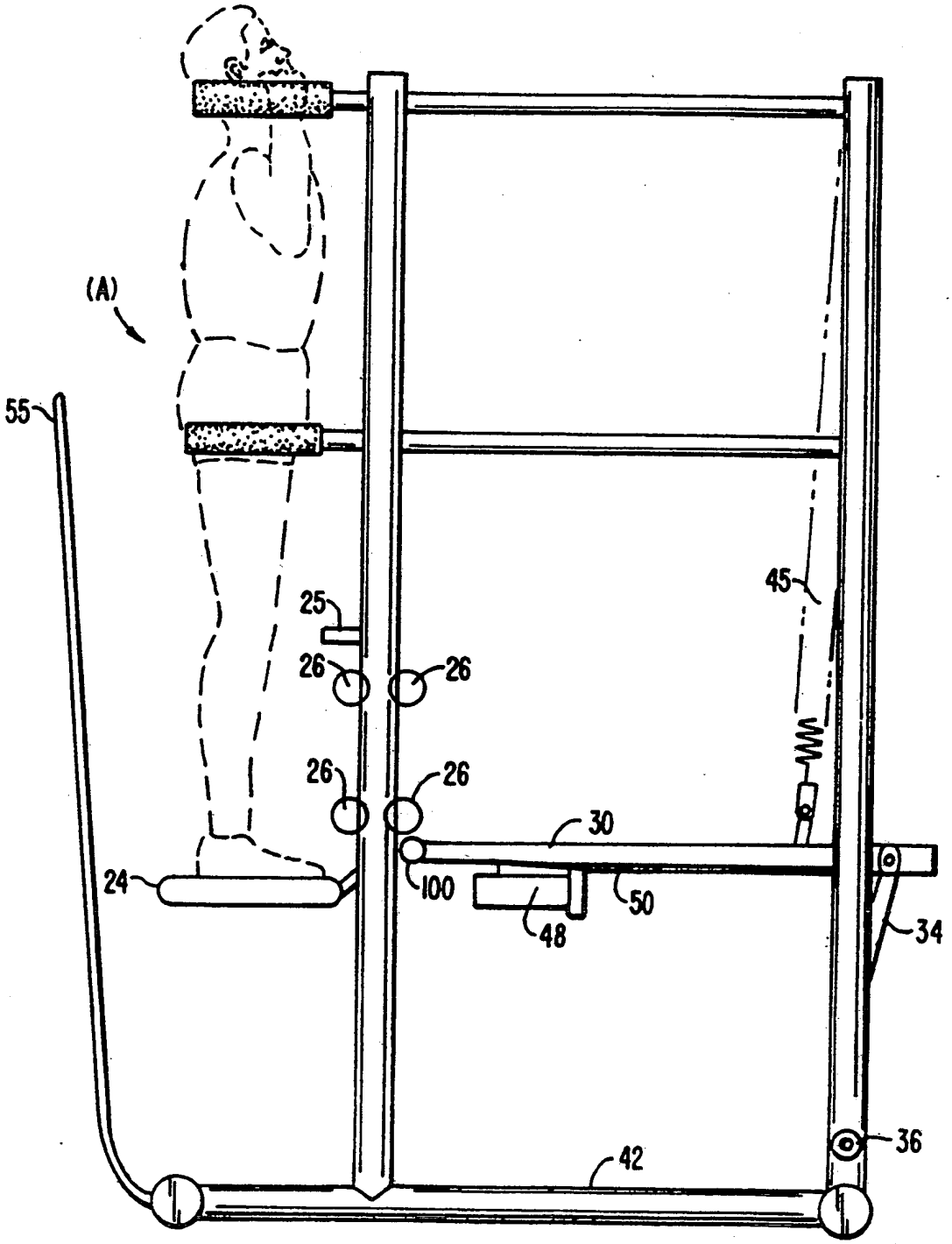


FIG. 8.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/02717

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A63B 21/00,22/00
US CL :482/41,51,92

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 482/26,41,113,51,92,93,95,142,148

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US,A 5,011,139 (TOWLEY) 30 APRIL 1991 SEE THE ENTIRE DOCUMENT	1-11
X,&	US,A 4,846,458 (POTTS) 11 JULY 1989 SEE THE ENTIRE DOCUMENT	1-11
Y	US,A 4,341,380 (SAUDER) 27 JULY 1982 SEE THE ENTIRE DOCUMENT	1-11
Y	US,A 3,716,231 (MARTIN) 13 FEBRUARY 1973 SEE THE ENTIRE DOCUMENT	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 27 AUGUST 1992	Date of mailing of the international search report 15SEP 1992
Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer STEVE CROW Telephone No. (703) 308-3398

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